

## **Cell Division Lab Analysis**

Read the information below and complete the tasks that follow.

### *The Effect of Environmental Stimuli on Onion Cell Division*

#### **Introduction:**

In an effort to increase production of onions as crops, scientists are studying how added natural environmental stimuli might increase onion root growth. Onion roots are small and increased root growth may lead to increased water and nutrient absorption. Scientists have also found fungal pathogens that grow in the soil can produce a lectin-like protein found in the area around the soybean roots. This protein may have been secreted by the fungus. Lectins in general induce mitosis in some root apical meristem tissues. Lectin may therefore be a promising chemical to add to the soil around onions to stimulate root growth and decrease time between plantings. In many instances however, rapid cell divisions induced by lectins weaken plant tissues. One alternative would be to use a different chemical to stimulate root growth. One choice would be caffeine. Caffeine has a stimulating effect on some organisms and perhaps it could have some impact on cell reproduction.

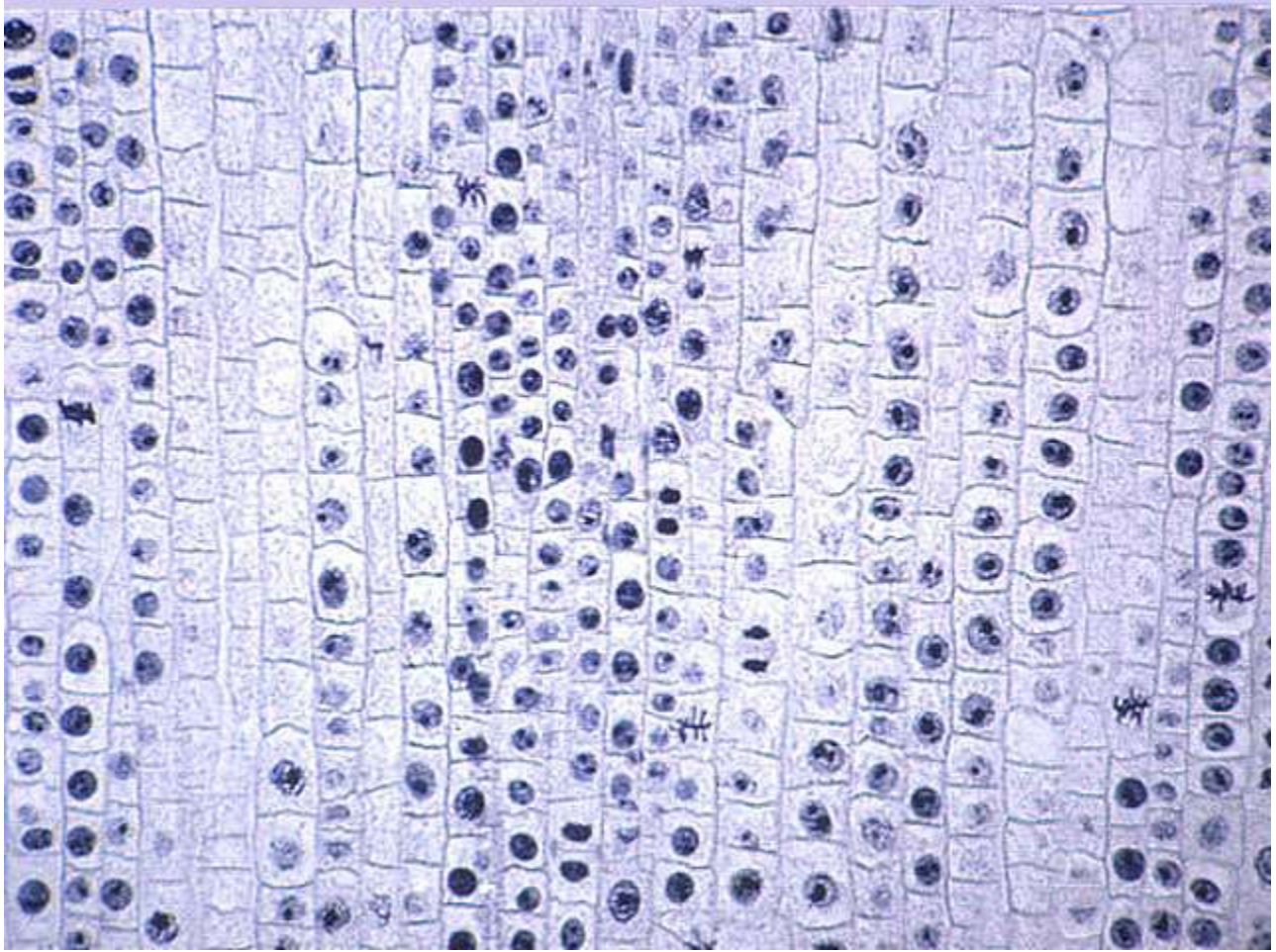
#### **Methods:**

1. Onion roots were grown in water (control), lectin solution, or caffeine solution.
2. The onion tips were harvested and fixed by soaking in 1M HCl for 5 minutes, then 100% ethanol for 20 minutes. Toluidine blue was used to stain the cells.
3. The cells shown on p. 2 were counted using a Nikon digital light microscope.

#### **Results**

*Table 1: Effects of water, lectin and caffeine on cells of onion root tips.*

<b>Tip Treatment</b>	<b>Number of cells in each phase</b>				
	<b>Interphase</b>	<b>Prophase</b>	<b>Metaphase</b>	<b>Anaphase, Telophase &amp; Cytokinesis</b>	<b>Total</b>
Control	460	43	8	24	535
Lectin	417	117	51	41	626
Caffeine	330	79	13	10	432



### Data Analysis

Show all work below neatly on separate paper for full credit.

1. For **each treatment** in table 1:
  - a. Determine the percentages of cells in **dividing** and **non-dividing** phases.
  - b. Generate a **pie graph** of data for dividing & not dividing cells.
2. Below is a question that can be tested using this data.
  - a. Propose a **null hypothesis** to test for the question.

**Question: Is caffeine a viable replacement for lectin to stimulate greater onion root cell growth?**

Null Hypothesis:

b. Perform a Chi Square analysis for EACH treatment group (caffeine & lectin) to test your hypothesis.

1. For these analyses, the number of **treated** cells in interphase (non-dividing) and mitosis (dividing) will be the **observed** (o) values.
2. To find out what your **expected** values are, complete the following steps:
  - a. Calculate the percentage of cells in interphase and mitosis in the **control** group from Table 1.
  - b. Multiply the percentages by the total number of cells in the **treated** group; this will give the expected numbers (e) under standard conditions (baseline) using the data from the treatment trial.
3. Calculate the chi-square value & whether it is greater or less than the c.v for **each** treatment group.
4. Compare the 2 Chi square c.v.'s and analyze whether they show that the null hypothesis should be accepted or rejected.